Bulmer (T. S.)

COSMICAL VIEW

OF

CHEMISTRY,

AND

ITS RELATIONS TO CHOLERA

AND OTHER DISEASES.

BY

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THESIS.

CUSTOM, no less than rule, demands that every student who wishes to obtain *Gradus Medicalis*, after a certain course of studies in some legalized seat of Medical learning, should put forth a dissertation on some branch of Medical Science. I, therefore, not ambitious of worldly praise, nor yet fearing the scalpel of criticism, now add my humble effort to the thousand others gone before, and amongst which, many are far more eloquent and subtle than any which may emanate from me; and may it not be as the cobweb, drawn from the spider itself, but rather as the nectiferous honey culled from every flower by the industrious bee, bearing its fastidious sweets to friend and foe alike. Whether my attempt be a failure or success, I shield myself behind the adage of "humanum est errare."

Since nearly the whole medical field has been more ably explored than that of chemistry, I, therefore, prefer this branch of scientific knowledge, so as to enable me, without destroying fine-spun theories, or jarring with the received opinions of the times, to explore my path. It is not so arranged as to satisfy the refined critic, but the practical man, who is more intent on useful facts than on eloquent language and far-fetched theories; and may you find something therein to repay the trouble of perusal.

It is as difficult for history to indicate the country where chemistry had its origin, as to know with certainty the cradle of humanity; however, if we view it as an art, its existence is co-eval with man; and although at one period it was much neglected, yet, as a morning star momentarily obscured by a passing cloud, it has re-appeared with all its refulgent rays and dazzling plenitude of glory.

Now, if we take the first nations of the earth, and especially the Egyptians, Indians, Chinese, Hebrews and Phœnicians, they were well acquainted with industrial chemistry; and many valuable processes left by them have outlived the fall of empires, and probably will remain till the "crash of matter and the wreck of worlds."

Thousands of years have elapsed since the Indians extracted gold, silver, copper; but, by what means, it is impossible to state; and if we refer to the time of the siege of Troy, (Homer's Iliad B. VI. "directing against each other their brazen shields,") amalgams were then well known. The ceramic art amongst the Indians discovered in borax a powerful auxiliary. The Chinese ascribe more than sixty centuries to the antiquity of their race, but have forgotten alike the names of the inventors, and the epoch of the discovery of gold, silver, copper, iron, zinc, &c. They manufactured bronze and brass before they knew how to write: and the preparing of the alloy of the gongs, that of metallic mirrors, and the pac-fong or German silver are very remote. The discovery of sulphur permitted them to become truly scientific in the manufacture of vermillion. We find the ceramic art arrived at great perfection, which Europeans have scarcely equalled; and their porcelains are still of great value. We might extend our remarks to the plastic art; as well as to various paints, dyes and varnishes, and even to the vitrification of glass and porcelain; and our best artists have not yet succeeded in making their old lac; and although their ink is only composed of lampblack and gelatine perfumed with musk, still no one has as yet succeeded in making it in so satisfactory a manner. Common salt, borax and nitre have been known in China from the most remote periods; and the mixture of nitre with sulphur and charcoal enabled the Chinese to make, before any other people, fire works and war instruments.

Now if we turn our attention to Egypt, and examine their enamels, their glazing and purification of gold and

silver, both by cupellation and depuration,—for they were acquainted with nitric acid,—their essential oils for perfumery, we shall be struck with the talent and ingenuity displayed by them in industrial chemistry. Turn to Tyre, and tell us—of what history gives us no idea—how to manufacture the celebrated purple; which some suppose to be derived from mollusca. Again pass to Greece and Rome, we find nearly all the metals and chemical riches of India and Egypt. Examine their Etruscan vases and enamelled glass, and if we possessed the writings of Pliny, added to the knowledge disclosed by the analyses of Klaproth, Girardin, Chevreul, and others, a mine of rich knowledge would be disclosed to us on the subject of colors for painting. The Romans were familiar with dissolving precious stones, and making endurable cements. They extracted starch from wheat by fermentation; and we are as yet ignorant of their painting process called encaustic, while their perfumers prepared highly esteemed pommades and ointments.

They extracted sugar from wheat, as well as narcotic properties from lettuces and poppies. The papyrus of Egypt and that of the kingdom of Naples and Sicily furnished them with good paper.

Their physicians knew many pharmaceutical preparations, also many deadly poisons, and could preserve dead bodies nearly as well as the Egyptians.

With the fall of the Roman empire a long night begins; all the elements of society were in a state of ferment; but in the 5th century, we hear of a sacred science, a kind of empirical chemistry, mixed with superstitious practices: then the alembic and distillation were put in use. This probably was the age of the discovery of alcohol, also said to be invented by Geber in the 9th century.

About this time Marc the Grecian wrote a book on pyrotechny, in which the art of manufacturing war-powder is indicated.

In the war of the Crusaders, we find every kind of incendiary composition was used, while naphtha took the name of Greek fire, and became a terror to the Crusaders.

From that time true chemical preparations began to appear. Geber taught how to prepare caustic potash by lime, also sal-ammoniac, and applied the alembic to prepare aqua-fortis and aqua-regia; and obtained lunar caustic, corrosive sublimate, oxide of mercury, and liver of sulphur; Rhases distilled sulphuric acid, and rectified alcohol by lime; while Avicerne found iron in meteoric stones, and Actarius distilled perfumery and scented waters. This was the 13th century; and although the alchemists labored much, still they really discovered nothing, being too much occupied in searching for the philosopher's stone, and the transmutation of base metals into gold.

In the 15th century Pierre le Bon introduced stannate of lead; and Eck of Sulzback discovered the tree of Diana, increase of weight of mercury when oxidized, and reduction of mercury by heat (1487). All these facts, studied by Lavoisier, three centuries later, have been the starting point of regular chemistry.

To Bazil Valentine (1413) we owe much, such as the discovery of several salts of antimony, hydrochloric acid, fulminating gold; and he prepared from iron itself the sulphate. He described preparations of acetate of lead and copper, also carbonic acid, but without determining its properties, and gave the name of bismuth to a metal confounded with lead and tin.

Leonard di Vinci, in the 16th century (a man equalled by few in this epoch), found air was necessary to flame, and where flame died out, life could not exist; and in a large flame gases which air does not touch, escape. But his discoveries were so well concealed, that but for Venturi, who copied his manuscripts, they would have been unknown to the present time.

In the beginning of the 16th century Paracelsus explained respiration and combustion; the combination of oxygen with metals, &c., the decomposition of water; and that charcoal reduces metallic oxides; he also wrote on zinc and zaffre (or silicate of cobalt); while Duchesnes extracted gluten from flour, which, two centuries later, Beccaré made better known, and explained the method of preparing.

Van Helmont (16th century) first taught the properties of the gaseous atmosphere, and gave the name of gas to carbonic acid, or Sylvestris spirit, he also preceded Hales, Priestly, Sennebier, Saussure and others, in the study of vegetation.

In the 17th century Libavius obtained crystals of sugar, alcohol from amylaceous substances, and bichloride of tin, called by himself the smoking liquid of Libavius. Alum and graphite were first noticed by Andrew Cesalpino; while Bartholomew of Modena first treated gold and silver ores by amalgamation; and the city of Venice was renowned for superior paints and enamels which France and England have scarcely yet equalled.

Boyle (17th century) gave much attention to chemistry, and studied amalgams and union of gold and iron.

Mayhow separated oxygen under the name of *Nitro-etherial Spirit*, and ascertained its action on animals and vegetables.

About this time chemistry was applied to the speculative sciences.

Precious stones and diamonds were burnt in Florence by J. Averain and C. Tergioni, by means of a powerful lens constructed by Bregen during the reign of Como III (1694), which experiment Davy repeated in 1814. Watson discovered "white metal" or platina; whilst a most valuable discovery so essential in our days, was taught on the use of scales by Bergman, who, by recommending their use, contributed above any other to perfect experimental chemistry, and to divest science of all obscurity, which the study of simple

organoleptic properties of bodies had been wrapt in, till that period; this was the state of science when Scheele and Priestly appeared, the great predecessors of Lavoisier. Stahl introduced the phlogistic doctrine; his essay was the first on chemical theory, which Lavoisier and a thousand others refuted (1774); sometime after followed Dalton on atomic and proportional numbers. In modern times chemistry has received a great impetus, and so high a state of perfection, that scarcely any branch or profession can be profitably carried on without its assistance; take for instance soap-making, where an excellent knowledge of qualities, and of combination of fats with alkali is necessary, so as in dear times to buy the cheapest and most suitable oils, for chemical change and profit; and in calico printing and dyeing, we should be able to use the most suitable mordants.

Agricultural science has truly received many valuable hints in the way of testing soils, decomposing stones, and other deleterious agents such as composts; while extracts of fœcal matter, phosphate of lime and guano have enhanced the valuable property near cities more than 100 per cent; and so well has agricultural chemistry been received in France and Germany, that, in the latter country, Mr. Thaer in the town of Tell, Hanover, founded a School of 400 acres (1800), and, at the present time in England we find several—one of which I had charge in 1849, situated at Doncaster, for the education of farm-servants, under the control of a "Board of Guardians" for twenty-eight parishes.

The United States are becoming alive to their interests, and at present have not less than ten agricultural schools in operation, viz: in the States of Michigan, New York, Vermont, Minnesota, Maryland, Pennsylvania, Massachusetts, and Iowa: the largest are at Bellefonte, Amherst, and Roxbury, the latter cost $250,000.

Chemistry is alike useful to peasant and king, both in its relations and importance to agriculture, mineralogy, and

medicine; all its bearings are interesting to mankind whether in examining our food or drink, for "there is a poison drop in man's purest cup;" and well does it become us to test if there is "death in the pot," as is the title to one of our English adulteration works. The chemist in his daily pursuits enjoys a source of pleasure unknown to the uneducated or illiterate person. Many facts which habit has made us view with indifference, are interesting to mankind, who enjoy a knowledge of this science. Everything pleases, amuses and instructs the chemist; all material substances are a mine of wealth to his enquiring mind.

Examine our bodies and consider about one hundred muscles brought into play in the act of speaking and breathing, and each of these has chemical force brought into action.

Every act of respiration, and all the functions of the body, and especially the changes of the blood, and organs of generation, are purely chemical changes.

Examine the coral rock and sponges; and tell us what small animalcules can do as chemists. "Mountains exult where the wave hath been," and to use another poet's expression, "Ye're a puny race thus boldly to rear a fabric so vast, in a realm so drear." Put clean soil under galvanic force for one hundred days and nights, and explain how its action brings forth animalcules, examine the horny hand of the mechanic, and say, why ordinarily friction diminishes a body, but in the latter case thickens it. All nature teems with chemists, and in one word, the very milky galaxy, the sun and illimitable abyss of space, which reveal the work of the great Architect, are subject to the same chemical rules and power which "moulds a tear, and bids it trickle from its source," and without which the huge animal on which we reside, with all its enormous arteries and veins permeating through it, would be torn asunder, and Chaos again rule supreme: and when the liquid flesh within us has ceased to permeate our bodies, and the subtle principle

no longer controls the mind, then, and only then, does chemistry hold supreme control, and death is swallowed up in victory. If we now turn our attention to modern chemistry, we find no walk in life can be successfully trodden without it. Direct our steps to sugar-making, we find nearly half the article used in France is made from beets; whilst various canes, trees, and even old rags produce it; and bread, though not the best, has been made by a peculiar process from saw-dust (Irish National Series); and iron slag, formerly useless at iron foundries, is now used as emery at one-fifth the former price.

In a medical point of view several valuable extracts and medicines have been found useful in the healing art, such as oleum jecoris, glycogen, quinine, salicin, morphine, leptandrin, podophyllin, codeiæ, jalapin, and cranin. Quinine is now obtained by extracting with coal oil (*vide* Applied Chemistry), and a substance resembling quinine has been found as a constituent of the human body, called "*Animal Quinoidine*;" it acts on the spectrum precisely as a solution of quinine, is a fluorescent substance, and supposed by Dr. Bence Jones and M.M. Dupré as one of the earliest products of the downward passage of albumen. The method of dialysis, lately discovered, is now applied in determining the nature of the crystalline constituents of plants.

The fumes of the tincture of iodine are found to be an excellent remedy for headache, and oil of box for toothache and gonorrhœa; while podophyllin has considerable analogy in action to calomel on the human body. By the method of dialysis, the minutest traces of morphine, bromine and digitaline can now be detected in any fluid, a fact invaluable to toxicologists. In surgical practice Dr. De Serc has effected a new application of voltaic heat (1500° centigrade) produced by electricity by which a platinum blade will cut flesh instantly (Lancet). The Sphygmograph is very valuable to physicians in giving a self-written record of the

movements of the pulse, so as to distinguish different pulsations in different stages and diseases, imperceptible to the touch of the hand. Again: what was formerly thought impossible to test, viz: mixtures of essential oils with turpentine, are now easily found out, as most volatile oils rotate the plane of polarized rays of light. If we enter on the study of the human system, as done by Professor Houghton, (Trinity College, Dublin), we find there is a relation between force used and urea generated, that physical waste destroys less than mental study, and that two hours' labor of the brain exhausts more than one day's physical labor.

If we examine the ocean, two million tons of silver are found in solution, as well as enormous quantities of manganese, sodium, bromine, copper and other metals; in some seas chloride of sodium is so abundant as to be 25 per cent. of the whole; while others yield nitre, asphaltum, and amber, and even Lake Clear in California yields borax.

The various causes of colors of the different seas were mere conjecture; now, it is clear enough that the blue color is due to ammoniate salts of copper; and the green to chloride of copper. In the discoveries in swamps and morasses we find coal-oil, and a peculiar substance resembling stereoptin used for manufacturing candles; while copper and iron pyrites have been found in North Wales peat. Mr. John Moss (England) informs us that the heaviest metals are at the centre of the earth on account of their specific gravity, hence, we may expect to find gold there in abundance. As the speculative American has not yet commenced boring for this precious mineral, we may suppose he either doubts the remark or is unaware of Moss's assertion. The Olefiant gas is now superseded by the Arabian laughing plant.

In Palgrave's description of "Central and Eastern Arabia," some particulars are given in regard to a curious narcotic plants: "Its seeds, in which the active principle seems chiefly to reside, when pounded and administered in a small dose, produce

effects much like those ascribed to Sir Humphrey Davy's laughing gas; the patient dances, sings, and performs a thousand extravagances, till after an hour of great excitement to himself and amusement to the by-standers, he falls asleep, and on awaking has lost all memory of what he did or said while under the influence of the drug. To put a pinch of this powder into the coffee of some unsuspecting individual is not an uncommon joke; nor is it said that it was ever followed by series consequences, though an over-quantity might perhaps be dangerous. The author tried it on two individuals, but in proportions, if not absolutely homœopathic, still sufficiently minute to keep on the safe side, and witnessed its operation, laughable enough, but very harmless. The plant that bears these berries hardly attains in Kaseem the height of six inches above the ground; but in Oman were seen bushes of it three or four feet in growth, and wide spreading. The stems are woody, and of a yellow tinge when barked; the leaf is of a dark green color, and pinnated, with about twenty leaflets on either side; the stalks are smooth and shining; the flowers are yellow, and grow in tufts, the anthers numerous; the fruit is a capsule, stuffed with greenish padding, in which lie embedded two or three black seeds, in size and shape much like a French bean, their taste sweetish, but with a peculiar opiate flavour; the smell heavy, and almost sickly."

We might go on enumerating many wonderful discoveries, but it is only our intention of touching on a few others, rather more scientific and difficult for the unpractised chemist or novice; but sufficiently interesting, to draw the attention of all to the great truths and practical bearings of chemistry, and to give a stimulus to one of the most useful sciences in existence. Let us now turn our attention to electricity, the calcium light; the manufacture of paper from wood, and rice straw (of Formosa), and linoleum from linseed oil, a substance resembling gutta percha, which can be applied to all purposes for which the latter article has been used; the process

is too tedious for explanation; however, Mr. Francis Walton of England has oxidized or solidified the oil, and in combination with gums, &c., has formed a very valuable compound. It acts as a cement for iron and wood, is as hard as birch, can be turned in a lathe, and is nearly indestructible by fire.

Call on our cousin Jonathan, he has obtained kaoline and manganese in Virginia, and has a manufacture of porcelain in full blast; while Dr. Doremus of Newark, (United States) has publicly exhibited quantities of solidified carbonic acid. A new substance is also found out under the name of Carbolic or Phenylic acid, an hydrated oxide of phenyl ($\overset{C}{12}\overset{HO.}{5}\overset{HO}{}$), which is the best present treatment for skin diseases and especially Lupus. It is also the best disinfectant; and, injected into dead bodies, will allow them to be publicly exhibited without any smell.

Anatomical specimens, and entire animals may be preserved, in a fresh condition, in vessels smeared over in the inner side with Phenic acid, provided the vessels are hermetically sealed, so as to prevent the removal of the air contained in them. In injecting a body for exposure to the air, the acid should be dissolved in water.—(*M. Lemire Academ. Scien.*)

Carbolic acid is a colourless transparent oily liquid, with a burning taste and the odor of creasote, to which it bears a great resemblance. It has no effect on litmus paper; it communicates a blue tint with the persalts of iron like salicylous and salicylic acids. It was originally obtained as a product of the dry distillation of coal-tar oil. It exerts a very poisonous action on the human system. Petters says inunction with tar ointment seems to occasion the presence of carbolic acid in the system. The color of precious stones, such as emeralds, &c., can now be successfully removed.—(*Lewy*, 1858, *Paris.*)

In discoveries of explosive mixtures we have many such, as nitro-glycerin, soda-amalgam, oxide of kakodyl, and lastly by passing coal-gas through a neutral solution of nitrate of silver; while if we treat anhydrous acetic acid, benzoic or succinic

acid with peroxyde of barium, with the former we have an explosive mixture with considerable bleaching powers, (peroxide of acetyl). It is a viscid liquid crystallized by artificial cold (Sir B. Brodie's lecture before C. S. London). We have also a dangerous mixture called Pharaoh's serpents, which consists of sulpho-cyanide of mercury.

The lately discovered coal oil * has originated an almost interminable number of preparations, whilst the essential oil of gaultherium, introducted amongst compound ethers, has a striking similarity to fruit.

If we dissolve copper in ammonia, we have a solution by a peculiar process, of dissolving lignin, cotton-fibres and other articles, of practical use to paper makers ; and a preparation of iron can now be used instead of animal charcoal in the refining of sugar. Gun-cotton is now used for filtering strong acids, and a new process is practically applied to prevent the explosion of gunpowder and lucifer matches.

Hydriodide of ammonia is a solvent of nearly all mineral substances, and a new test is brought forward for acids and alkalies which is far more sensitive than litmus. It was discovered by Schonbein and called "cranin" ; it is obtained by acting on chinoline with iodine of amyl ; it will detect $\frac{1}{1000000}$ th. part of sulphuric acid in water, also caustic potash, and quantities of carbonic acid untraceable by calcium or barytes. Magnesia will not dissolve sufficiently in water to allow the solution to react on litmus, but it is easily proved by this test to be present ; again, sulphuretted hydrogen can detect

* The collection of petroleum is generally regarded as a modern discovery made by Drake. But Herodotus, who lived 2300 years ago, about the period of the prophet Malachi, speaks of the collection of petroleum in the island of Zante, on the western coast of Greece. Dr. Chandler, in the early part of the present century, visited Zante, and found an oil-well in full operation, thus confirming the narrative of Herodotus. The patriarch Job had undoubtedly visited that well, or some other one—a *flowing well at that*—otherwise he would not have thought of the "*rock pouring out rivers of oil.*"

$\frac{1}{350000}$th. part of lead in solution; but traces of lead, undetected by this gas, have been tested by "cranin." If you distil indigo with potass, you have aniline with derivatives such as futschine, violine, emeraldine, and bleu de paris.

Let us now turn our attention to Ethers, *e. g* Capryl ethers which have aromatic odors, and will soon enhance enormous profits. The Valerianate of amyl-oxide has a smell resembling pears, and the essential oil of pine-apple is only butyrate of ethyloxide, and what surprises us more is, that the pleasant flavor is only obtained by diluting the ether with alcohol. Cognac and grape oils are a combination of amyl dilu ted with milk alcohol; while nitro-benzol (Mitscherlick, 1834) is converted into oil of bitter almonds. Benzole, since 1845, has been produced in large quantities by means of coal-tar; and, lastly, acetate of amyl-oxide acquires the flavor of jargonelle pears by diluting with six times its volume of alcohol. The last two inventions of which we shall now speak are so interesting, and just in infancy, that a few remarks are necessary, viz: Electricity and the largest lens in the world, now manufacturing for the last six years at Gobain, in France, two feet in thickness, and from which we expect great revelations concerning the celestial spheres. Electricity was understood as early as 1600; it was attributed to Addison, but he was indebted for his information to Strada, an Italian author, born at Rome, 1572, died 1649. He wrote "Prolusiones Academicæ." In the sixth Essay he refers to the action of dial-plates, on which were inscribed the alphabet, and the needles though hundreds of miles away, acted in unison when separated by mountains, forests, and valleys. It has now reached such perfection that an English Lord in a London office lighted his cigar from sparks given out at Heart's Content; and Mr. Kaulback (London Invent. Society) proposes a permanent way or bridge beneath the surface of the ocean; by means of sunken vessels, with which sailing crafts on the ocean can telegraph to any port, when needed; or, in other

words, telegraph posts can be established in mid-ocean. We might have enumerated many other excellent discoveries, which account would fill a large volume; but, as a deadly disease makes perennial visits, carrying off many of our inhabitants, and since it is thought to be in some mysterious manner connected with a peculiar state of the atmosphere bearing on chemical or electrical changes, I will devote the rest of my thesis to a cursory review of this disease in all its bearings, mentioning the theories in vogue regarding it, and the electrical changes which appear as a kind of harbinger at that special period of affliction. I shall first refer to disinfectants, which have been so seduously praised by many celebrated physicians as preventives against smells, especially, as smells are indicative of that state of the atmosphere supposed to be favorable to the development of cholera, and other malignant diseases. But it is well to know that several foul gases are far from being unhealthy, and that a state of atmosphere might exist, filled with deadly malaria, which cannot be detected by our senses. The land breeze, off the South American coast, which brings *black vomit*, is apparently as refreshing as that which blows "so soft o'er Ceylon's isle." Not a sign of the terrible miasma from the deadly forests of the plague-ridden spot can be found, which fills every breath of air you draw with poison; the sky is cloudless and the atmosphere apparently odorless, yet you receive the black vomit and die. Can you disinfect that sort of poison? Go westward, on the Yellow Maumee (Ohio), while there, your system is absorbing the seeds of ague and disease; still you smell nothing, see nothing, and feel nothing.

Cross the isthmus of Panama, where nature is gorgeous, and the heavens as clear as crystal; yet you still imbibe the well-known fever, so fatal that few patients seldom recover entirely from it.

Bad smells, as in soap-factories, tanneries, &c, exempt from cholera if statistics are correct. But allow me to say

that a peculiar property in the human body generates a deadly fever, fatal in nine out of ten cases. Shut an individual up in a dungeon for some time, keep him in this foul atmosphere, and when he goes into the open air, you will see an insensible perspiration passing from his system; you will catch this fever and die. (*Vide* Report of Black Assizes, Oxford, 1674, where judge, jury and court were attacked.) He is like the poisonous adder; unless he inoculates himself, he will escape the poison; he carries it with him, and whoever imbibes it is sure to die. If mere dirt breeds cholera, surely we should have an annual visit. But its action is a mystery, the same as the sweating fever of the 14th century.

Now turn our attention to Ozone, not yet perfectly understood. It is easily obtained by putting sticks of damp phosphorus in a large bottle, and closing the same tightly; also by passing electricity through water; but to obtain it in large quantities, we must treat the binoxide of barium or bichromate of potash with sulphuric acid. It decomposes iodide of potassium. If a starched paper be dipped in a solution of iodide of potash and exposed to ozone, the iodine is set free, and the paper colored blue by the iodic action.

Faraday says, Ozone is one of the forms of oxygen, which is allotropic in character, capable of appearing in various physical states; while Dr. Baumert and others maintain that it is a super-oxide of hydrogen.

We have a very simple method of testing it, which is to put white unsized paper saturated with tincture of guiacum and dried in the shade, into a small quantity of ozone, which will immediately turn the paper to a blue color.—(*M. Honzeau and M. Poer.*)

We find its smell resembles putrefied fish. It oxidizes silver, and turns nitrogen into $\frac{NO}{5}$. We find in large crowded cities by the ozonometer (which detects $\frac{1}{5000}$th. part in the atmosphere) that ozone is quickly used up, and more so in filthy localities. Heat destroys ozone. We are certain the

inhalation of ozone produces inflammation of the throat and mucous membrane; the reason why these diseases are more powerful in winter than in summer is the absence of heat and the more active ozonic condition. Ozone is generally understood as a supporter of life and vitality, and at the same time generates disease.

Ozone is destroyed by breathing, and the oxygen left is rendered negative in action; Catarrh is brought on by inhaling too much ozone. Animals subject to large quantities of ozone are often seized with congestive bronchitis, and die.

The absence of ozone renders healing of wounds slow; hence the idea that tissues and bones seldom become strong before winter.

Schrötter says the odor of Welsendor spar depends on ozone, but Schönbein and Messner say it is antozone. M. Wyrouboff (April 20th, 1866, Chem. Society, Paris,) says, what the above writers suppose of this spar is a mistake, as it is only hydrocarbon in the fissure of the stone.

M. Weltzien, in his communication (Chem. Society, Paris,) on Peroxyde of Hydrogen and Ozone and Antozone, does not believe in antozone, and takes the old view of the constitution of peroxyde of hydrogen. Ozone, he takes to be proved, is simply condensed oxygen. Regarding the affinity of ozone, we are aware that when any combination is known to take place between nitrogen and oxygen, ozone is always present. It is allowed that the first results of a combination between nitrogen and oxygen, whatever the subsequent decomposition and recomposition may be is $\frac{NO}{2\ 3}$.—a compound which, according to Dr. Hoffman, is the perfectly balanced and self-satisfied body of the nitro-oxygen series. Now, connecting this to the recent discovery of M. Soret, that ozone is a tetratomic oxygen, there is some reason for believing that nitrogen combines only with ozone at least in ordinary temperatures. The equation representing the combination of nitrogen with oxygen, seems likewise to point to this conclusion. What is the mode of

expressing the formation of $\frac{NO}{2\ 3}$, from N and O, that chemists adopting the newer views are obliged to adopt? Why the following complex formula,—(NN) + (NN) + (OO) + (OO) + (OO) = 2 $(\frac{NO}{2\ 3})$.

"Here, then, we are quite unable to express the formation of one molecule of $\frac{NO}{2\ 3}$, but are obliged to make two by bringing together two molecules of nitrogen and three of oxygen.

" How simply, on the other hand, could the process be represented, if we supposed the nitrogen as only capable of combining with ozone,—(NN) + (OOO) = $(\frac{NO}{2\ 3})$.

" One molecule of nitrogen *plus* one molecule of ozone gives one molecule of $\frac{NO}{2\ 3}$" (Royal College of Chemistry.)

Ozone has much to do in relation to cholera, and it professes several properties not yet understood by us; and that sooner or later these properties will eventually be a remedy, if any, to cholera. The only true remedy at present most likely to succeed, is what will prevent the action on the mesenteric glands, such as ice to the spine, &c., and also, what will prevent the passing away of the salts of the blood.

But whatever causes may originate cholera, it is still a great mystery, and is doubtful may be so for some time longer. One fact however strikes us very much regarding the origin of cholera in London, 1831. A Royal Commission was issued to enquire into the cause, when it was ascertained that in the first house where cholera originated, the people used the well-water into which a filthy sewer emptied: after the prohibition of the use of the water, the cholera diminished at once. " In the summer of 1866 a peculiar disease, even more virulent than cholera, broke out in a village near Suez. The victims dropped in the street, as if shot. Their appearance at first, was that of brown paper, but immediately they became as black as coal.''

Regarding the action of the atmosphere, affecting the body in cholera or in other diseases, I may state we are considerably influenced both by atmospheric changes,

as well as an electrical state of the earth. When thunder-storms are of rare occurrence in summer months, indicating an unusual absence of atmospheric electricity, this agent passes imperceptibly from the living body, and rapidly if the atmosphere be in a humid state, until the electrical power is so far reduced, that negative forms of disease everywhere prevail. Cholera asphyxia is well known to involve a cold or very negative state of the system. In this leading characteristic, it is the opposite state to a fever. It is attended with a slow pulse, general lassitude, and rapid decline and suspension of all the vital functions. It is a well known fact that the year 1832 (in the summer of which the cholera raged so fearfully in the United States) was distinguished by an almost absence of electrical phenomena; nor is it less a fact that during that season there were no fevers, or at least, that the fevers were of rare occurrence. About the first day of September, there were violent electrical storms in different parts of the United States, and the cholera totally disappeared.

Dr. Robillard, of Montreal, states that while a student in Paris, the various changes of the weathercock brought an increase or diminution of cholera deaths; as was proved by examining the hospital statistics.

That opposite electrical conditions produce fevers and inflammatory state of the body, is doubtless true. I will, however observe, that those phases of vital derangement which I denominate the positive forms of disease, are wholly different in their symptomatic aspect from the class previously described, and characterized as negative diseases.

The disorders which result from an excess of vital electricity in the body as a whole, or from an undue concentration of this agent on some particular organ, are accompanied with a higher temperature, an accelerated pulse, and a general irregularity in the organic action. The extent of this derangement may be estimated by observing the perisystole as the electro-thermal currents rise and fall. Moreover the diseases

of this class are most general and fatal, when the atmosphere is in a highly electrical state, as evinced by frequent and violent thunder storms. History records violent thunder storms at the time of the death of C. Richelieu, Cromwell, and Napoleon. The results may admit of some modification from individual peculiarities and local conditions; but it is presumed that the correctness of our position will be confirmed by every careful observer. In the cure of the disease the vital resources are either augmented or the expenditure lessened.

Whether cholera is tetanus of the system or a poison imbibed acting on the mesenteric glands, we leave undecided; also whether the patient's blood is diseased and may germinate poison *de novo*, or by fœcal discharges, fermentation, and bad water, be that as it may, we incline to the view that a susceptibility, weakness, fear and the above mentioned causes combine to aid materially in bringing on the disease. We are, however, interested in noting the striking similarity between the sweating sickness of 500 years ago, and the cholera of to-day. The serum passes out of the system through the intestinal canal in the case of cholera; in the old disease it escaped rapidly through the pores of the skin; but the features of the diseases are much alike, and in both cases, death occurs by loss of blood, though the hematin is left behind. What we call rice-discharges are undoubtedly the colorless portion of the vital fluid, which leaves the system, and a fatal collapse then sets in; or in other words, spasms cause death, before purging and vomiting have had time to produce any deadly effect.

In the year 1820, a mass of reddish vapor was noticed one day upon the surface of the Yellow Sea; this singular phenomenon was observed by the Chinese of the province of Chantong, which forms its coast. These vapors were at first light, but gradually increased, became condensed, rose little by little above the surface of the water, and at last formed an immense red cloud, which remained for several hours floating in the air.

A violent wind suddenly began to blow, and drove them on the land. These red vapors spread in a winding course along the hills and valleys, and swept over the towns and villages; and wherever they passed, men found themselves suddenly attacked by a frightful disease, which in a moment deranged the entire organization, and changed a living man into a hideous corpse. ("The Chinese Empire," by Huc, vol. II, p. 24.)

For confirmation of the assertion that the cholera miasm sometimes assumes a visible appearance (*vide* "Travels and Adventures of an Officer's Wife in India," Mrs. Muter, 13th Light Infantry.)

Another example of the visibility of cholera miasm occurred in 1854, during the Crimean war. While H. M. S. *Britannia* was cruising in the Black Sea, a remarkable cloud was observed to hover over the ship, followed immediately by a tremendous outbreak of cholera among the crew, which laid many of them low within the space of a few hours.

The Black Death, "La Mortalaga Grande," was preceded by striking mists (*vide* "Epidemics of Middle Ages," by Hecker; published by the Sydenham Society.)

The sweating sickness, which commenced in England amongst the soldiers who fought at Bosworth field, was preceded by mists.

Klot Bey, an Egyptian physician, stated that Asiatic cholera has always originated among the Musulman pilgrims to Mecca, arising from filthy habits, and the decomposition of the offal of the countless sheep sacrificed by them.

Now if we follow with the eye the magnetic curves on the chart, we find the cholera reached St. Petersburg late in the autumn of 1830, and the icy regions of Archangel, on the White Sea, in the depth of winter of the same year, following throughout this course the direction of the magnetic curves. Then the influence struck (westward) another series of magnetic curves (as if by induction), and passed down the magnetic line, which extends from Riga, on the Baltic, to

Odessa, on the Black Sea. In 1831, still progressing westward, it struck the lines which pass through Warsaw, Cracow, Berlin, Vienna, Constantinople, and Alexandria, in Egypt.

Early in October, 1831, Hamburg was attacked by the disease; and on October 26th, it appeared in London and Sunderland. In February, 1832, cholera reached Edinburgh, and a few weeks later it visited Dublin; both these places lying on nearly the same magnetic line, which curves in a south-westerly direction. But cholera did not approach France till the influence had been communicated to several fresh magnetic curves lying further westward, and then, in March, 1832, cholera appeared almost simultaneously at Calais and Paris, and spread from town to town, in defiance of quarantine restrictions.

For particulars regarding the cholera in Canada, in 1832-34, I refer to a small pamphlet published by a friend, the Rev. C. Dade, M.A., Georgetown, U. C., which is attached for reference to my Dissertation. He made many meteorological observations which coincide with my views. On page 5, he remarks, "Therefore the various atmospheric phenomena which precede and accompany the visitation of a pestilence are surely deserving of notice. 'Coming events cast their shadows before,' both in the natural as well as in the moral world, and he must be a shallow observer, indeed, who fails to note their indications."

Again he remarks "it has been said, that whenever cholera has arrived: deviations from the usual conditions of the season in temperature, and other features marked its advent and progress."

"And to enquire whether this was the case or not is the object of these remarks, founded upon indisputable facts, of which the (scarcely yet) infant science of meteorology stands so much in need!"

On page 7, he states, "As to electric phenomena, there were few thunder-storms, and none of peculiar severity;" (referring to August, 1832.)

In June, 1832, cholera broke out at Quebec; and if the reader will trace the magnetic curves which pass over the western part of France, he will find that they cross the North Atlantic Ocean, and to the Gulf of St. Lawrence.

In the same month (June, 1832,) cholera reached New York, and ravaged that part of the American continent, while a reflex current returned back to Europe on the curves which connect it with Spain and Portugal; Lisbon and Madrid being attacked in 1833.

Examine our painted walls and windows at Christmas, we behold moisture running down—whence obtained? From human exhalation; in summer it is the same. Collect and evaporate this moisture.

We have left a residue impregnated with albuminous matters extremely liable to become putrid, smelling like animal perspiration, and, if heated, gives off the odor of burnt flesh; or let it remain at rest for a short time, and examine it with the microscope, we then see crowds of infusoria gradually developed.

There is then animal poison in the insensible as well as sensible transpiration given off by the frame. Some pure river sand was calcinated by Faraday, and then heated along with the hydrate of potassa; it did not yield the slightest trace of ammonia. He now passed his hand slowly over the sand, which when treated in a like manner, afforded traces of ammonia. This shews matter passes from the body. Once more condense and concentrate the foul fluid, we are supposed to have collected. Introduce a small quantity into the vein of a dog, the animal will probably soon die after presenting many of the phenomena of typhus fever.

I might state as an experiment, that the Cerebrum in the human species has been irritated, so as to induce artificial diabetes (Dr. Day); if so, might we not, by acting on some of the spinal nerves such as the pneumogastric, so induce a cure for cholera, as is the plan of Dr. Chapman, by applying ice-

bags to the upper spinal column? Again: although spirits have been considered as very doubtful treatment in cholera, still, from the experiments of Dr. Bence Jones, with alcohol, if properly regulated in doses, they might be of good effect. The action on the system being so interesting; and as some poison can pass throughout the system in less than three seconds, I therefore give the circulatory course of this spirit.

"It passes through the stomach, and in going through is to a small extent oxidised. The greater part escapes, and enters the circulation, acting there on the oxygen, fibrin, albumen, and blood globules to a small extent. In a few minutes, a part passes into every texture, and on each substance in each texture the alcohol produces its chemical action, still, continually undergoing oxydation, so that, in a few hours, one part has entirely escaped, and another part has been entirely oxidised in the blood and textures. What has the alcohol done during this time? It has acted chemically on the oxygen, and on the textures with which it has been in contact. The first action has little to do with the strength of the alcohol. Weak or strong, it combines with oxygen, increases oxidation; increased circulation, increased secretion, increased effusion of lymph, altered nutrition result. The second action depends on the strength of the alcohol. Strong alcohol acts chemically on albumen, fibrin, and cellular tissue, etc. It has a powerful attraction for water, shrivels up cellular tissue, hardens fibrin, and precipitates albumen by its chemical properties. To no organs of the body is more alcohol taken than to the kidneys and liver, and in no organs are the mechanical results of its chemical action more manifest, and the consequences of the altered structure more apparent, and the increased oxidation, the increased flow of blood, the altered nutrition are identical in kind with the first action of inflammation; and when the series of actions are repeated over and over again for years, the result is the same as might have been produced in a shorter time, by an ordinary inflam-

mation, when no alcohol had been taken. The alcohol acts more powerfully on the interstitial structure than on the vessels and ducts."

From experiments made in London, and especially by those continually passing in the underground sewers of that great metropolis, as well as by ratcatchers in dirty kennels, still it appears the exhalations cannot cause cholera, they only retain their power of causing typhoid fever, and of aggravating the malignity of such diseases as erysipelas, scarlatina, and small-pox. Regarding further remarks on the cholera mist, or the theory of fungi originating this disease, I refer the reader to the essay of M. Glashier, published in the "London Times," (1866). As regards the theory of the poison being generated *de novo* in the system, it appears very improbable; but so far as the rice-water purging is concerned, it is very evident it is caused by the effect of the strong action of the inner lining membrane of the intestinal canal, which is actively engaged from within outwards, pouring forth enormous quantities of fluid; and this is just a violent effort to rid the blood of a poison in it, and this effort is excited through the influence of the splanchnic nerves, which are brought by the instinct of nature to bear on the bowels with such energy, that the nerves themselves become inflamed.—(Prof. Lizars, Edinburgh.) The true sinking pain at the stomach which many imagine to be hunger, is caused by the semilunar-ganglion, (at the small curvature of the stomach) and the trunks of the nerves issuing thence being in a state of enlargement and inflammation. This, I certainly consider accounts for the intense and insatiable thirst, the sinking gnawing pain at the epigastrium, and the irritability of the stomach, which are such prominent features of the disease; and as these inflamed nerves are connected with the great sympathetic, it explains also the dreadful spasms which are so marked a symptom of cholera.

To express an opinion on the injection of salts into the blood, I am not prepared to discuss; but, for those parties favorable to that method, I might say that, as Bernard has proved iodide of potash passes to the pancreatic juice and tears in less than a minute, and is detected in the bile and urine in one hour from exhibition; and again as several poisons run through the system in three seconds, a trial of these medicines would not be amiss. It might be interesting to state that carbonic acid and various salts impede coagulation. (Dr. Day.) Dr. Richardson says, "One part of ammonia in three thousand parts of healthy blood is all-sufficient to keep it fluid." We, however, know nothing regarding the action of salts on the coagulation of the blood, except, that dilute solutions of alkaline sulphates, nitrates, hydrochlorates, carbonates and acetates retard the process. (Dr. Day, Physiol. Chemistry.) I myself have tried various salts, and especially sulphite and chloride of soda, in many cases of malignant diarrhœa and dysentery without success. While living in Leeds (England), during the cholera sickness, many cases of recovery were reported as cured, by removing the patient into a healthier locality. For my part if ever, under cholera, in premonitory symptoms I would prefer Dr. Stevens' method, a little modified—namely, remove into an even temperature, administer a Seidlitz; if sinking, and no vomiting, give Epsom salts. When these agents acted, give thin beef-tea; if pain, a sinapism or turpentine to the gastric region; saltish drinks and ice *ad libitum*. If other symptoms came on with cold stage, stimulate the nerves to the heart, follow up by eight or ten injections of starch and salts, till stools change, as well as bathe in hot salt-water baths, and remove to pure air.

Camphor treatment has been much tried, and it is said, with success, by Dr. Rubini, at Naples; also arsenic, aconite, cuprum and digitalis; but I fear the death of the patient would occur before any decided action could be effected. How-

ever, arsenic does bring on symptoms somewhat similar to cholera, and if we could swallow the doctrine of *similia similibus curantur*, then an effort of trial might be made. Of the latter treatment, Aitken says, " It is a frequent cause of neuralgia, and likewise cures this disease."

Regarding the camphor treatment, I refer the reader to a pamphlet published by Jarrold & Sons, London.

I now refer to the secretions, excretions and vomited matter in cholera patients, and especially to the fluids, so that any deduction or theory may be examined into as influencing the formidable treatment of this mortal disease.

Valentin says, " The peculiar odor of the fæces is chiefly dependent on the decomposed bile," while Liebig refers it to the decomposition of albuminous matters, and founds his view on the fact, that something like a fæcal odor may be produced by burning albumen with potash; but albumen being small in quantity in the larger intestine, the former view is more probable.

Rice-water matters vomited in cholera have been frequently analyzed. They usually present a faint mawkish odor, and their reaction may be acid, neutral or alkaline. On standing they deposit epithelial structures (usually cylindrical epithelium) and mucus, the supernatant fluid being clear and yellowish. The fluid contains little organic matter, but a relatively large amount of inorganic salts, chiefly chloride of sodium. In the early stage, the vomited matter is acid, and butyric and acetic acids have been detected in it; when the fluid is acid or neutral, and contains no remains of food, urea is constantly present. If, on the other hand, the disease is further advanced, and symptoms of urœmia are established, the vomited matter contains carbonate of ammonia, and consequently has an alkaline reaction. Albumen occurs only very sparingly when the fluid is acid, but more abundantly when there is alkaline reaction; however, it is in smaller quantities in cholera than in dysentery and typhus.

As regards cholera stools, there is an abundance of epithelium in them, an extraordinary amount of water, a little albumen, very little biliary matter, an abundance of salts, of which chloride of sodium preponderates so as to exceed in amount all the organic matters. The solids are only 1.2 to 2.4 of all the evacuations. The addition of nitric acid gives rise to a rose-red tint in these stools, which is also often observed in the evacuations in typhus fever. In testing the evacuations in cholera for albumen we must neutralise the fluid matters with acetic acid before boiling, as they usually have an alkaline reaction. (*Vide* "Vogel's Pathological Anatomy," 1847, pp. 375-381; and Meckel von Hamsback, 1856.)

If we refer to the blood and serum in cholera, we find a decided and absolute diminution of the water in both, which diminution is only generally observed in cholera patients. Now turn to the post-mortem examination of a cholera patient, we have ænema of the lungs, less crepitation, partially collapsed, lower lobes congested, sometimes they pour out dark blood, and ecchymose appears on them and the pericardium. "The blood is usually of a tarry appearance and consistence, and putrefaction is unusually delayed." (Professor Tanner.)

In India, the dead bodies of the soldiers were so violently convulsed, "that their comrades, in order to calm the timid, bound the limbs to the bed-frame." Another remarkable circumstance is, that the temperature of the body often rises after death from cholera, the increase of heat being maintained for many hours. This rise of temperature sometimes happens together with the muscular contraction, but often also without it. ("Cholera Gazette," 1832.)

We have further in our post-mortem examination, the right heart full of blood, obstruction of blood, blood less coagulated. Left heart more empty; coagulation has enormous corpuscles.

When the shrunken warm appearance of the body passes away, then we have uniform distribution of blood. The intestines have a fæcal odor, and yellow matter is found in them. Often true inflammation at pylorus extremity of the stomach and duodenum is found. If these ulcerate, so do the mesenteric glands. With these remarks we ask the reader to prove all things, and yet one thing "experire."

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